3.4 Matrix representation of mixed numbers and quaternions.

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ABSTRACT

A quaternion is a four tuple with a scalar part and a three dimensional vector part. Mixed number is a sum of a scalar and a "vector" part. However the product of basis "vectors" (i, j, k) of quaternions is different from those of mixed numbers. Also mixed product and quaternion product are different. Mixed product is better than the quaternion product since the mixed product is directly consistent with the laws of Physics.

The sum and the product of the two quaternions $(a + \underline{A})$ and $(b + \underline{B})$ are defined respectively as

$$(a + \underline{A}) \oplus (b + \underline{B}) = a + b + (\underline{A} + \underline{B})$$

$$(a + \underline{A}) \otimes (b + \underline{B}) = ab + a\underline{B} + b\underline{A} - \underline{A}.\underline{B} + \underline{A} \times \underline{B}$$

The sum and the product of the two mixed numbers $(x + \underline{P})$ and $\left(y + \underline{Q}\right)$ are defined respectively as

$$\left(x + \underline{P})\right) \oplus \left(y + \underline{Q}\right) = x + y + \left(\underline{P} + \underline{Q}\right)$$

$$\left(x + \underline{P})\right) \otimes \left(y + \underline{Q}\right) = xy + x\underline{Q} + y\underline{P} + \underline{P}.\underline{Q} + i\,\underline{P} \times \underline{Q}$$

We have shown that the quaternions and mixed numbers can be represented by certain four by four matrices. In this paper, it is shown that a given quaternion can be represented by 48 matrices with 3 sets of 16 matrices in each, with the matrices in each set having the same determinant.

Mixed numbers can be represented by 96 matrices with 3 sets of 32 matrices in each, with the matrices in each set having same determinant.